A Platinum Tapestry: Weaving all the Elements Together

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I weave precious metal wire and sheet by hand. The process of weaving creates "fabric". I shape that "fabric" into ribbons and ruffles, spirals and loops, which become earrings, brooches, necklaces and pendants.

As a child, I wove potholders from knitted loops and made baskets from reeds. As a student, I wove with copper, aluminum, titanium, niobium, and, on special occasions, silver. I launched Barbara Berk Designs with woven sterling silver, and later added high karat gold. Now, I'm weaving with the ultimate precious material: platinum.

This paper will weave for you a tapestry from the many different threads which, when interlaced together, enable me to produce handwoven platinum jewelry.

First I'll illustrate the two major weaving techniques I use. Second I'll discuss my search to find platinum I could weave by hand. Third, I'll examine the questions raised during the search, questions that I didn't know to ask, issues I didn't know would need to be addressed - and how they were resolved.

Weaving is the interlacing of two sets of elements, one vertical and one horizontal. In my first collection, the vertical element - the warp - is sheet that's been cut into strips or wedges. The horizontal element - the weft - is multiple strands of thin wire twisted together. The pattern is a Plain Weave, in which the wire crosses over the sheet, then under the sheet, continuing over one warp, under one warp. A strong color contrast in the metals makes it easy to read the Plain Weave. The warp, the vertical element, can be sterling silver sheet; the weft, while the horizontal element is comprised of red magnet wire (resin coated copper) twisted with black silk thread. When the warp and weft are the same metal, it is not as easy to read the pattern. Four strands of thin wire are twisted together, creating a thicker weft, which is more malleable than a single wire of the same diameter. As the twisted wire weft crosses under the sheet, the sheet is pressed down over it, which "locks" the weft in place, and adds strength to the piece.

In my second collection, both elements are single strands of wire: a thin wire weft and a thicker wire for the warp. The pattern is called Soumak. It is a rug weaving technique, named for the city in Asia Minor in which it originated. The pattern is easiest to see where the ends flare out. The thicker warp wire of 18kt gold, provides strength; the thinner weft wire of 22kt gold, provides the malleability needed to do the tight wrapping that creates a dense weave. The warp is the skeleton, the weft is the skin; the two alloys in combination createa structurally sound piece.

With both the Plain Weave and the Soumak patterns, each piece is woven individually. The weaving is done flat: the plain weave rests on a thick sheet of plastic, so as not to mar the metal during weaving, and the soumak is supported in a small vice. Neither pattern is woven on a loom. When the weaving is completed, the edges are finished and then the woven "fabric" is shaped. The metal work hardens in the process of weaving and again in the process of shaping. My weaving, therefore requires metal that is soft enough to manipulate with fingers to create the "fabric", but that will work harden sufficiently to hold its shape when complete. (Customers tend to have limits on how participative they want their jewelry to

be: they really don't care for pieces that change shape as they're worn.)
A number of characteristics can be varied to achieve this combination of "manipulatability" and work hardening: metal, alloy, dimensions and temper. I've determined the formulas for gold that best fit my particular needs; my next challenge was to find the formulas for platinum. I knew platinum is much stronger and heavier than gold; that its high working temperatures and ease of contamination require separate, and in some cases, special tools and equipment. I knew that platinum was different from any metal with which I'd worked.

I decided to start with the Soumak. Though it is the more complex pattern, I could complete, shape and test a small piece in less time and with less metal than with the Plain Weave. Since I had no "finger knowledge" of platinum, I framed the question in terms that I knew: I wanted round platinum wire in two sizes to behave just like the 18kt and the 22kt round wire I was using. I reasoned that since I was going to weave a small piece, I could keep the sizes of the wires constant. The heavier platinum should not add so much weight as to make the piece uncomfortable. I then imposed a marketing consideration: ideally, I wanted metal that is at least 95% platinum so I could sell my jewelry in Europe.

THE SEARCH

My search started in earnest in the Spring of 1996. I needed two feet of .030" round wire and six feet of .012" round wire to test weave a Ribbon Clasp I didn't know what alloy or alloys I wanted, nor did I know the temper. There was lots of buzz about a new alloy, a spring platinum, that would be soft if it was heated and quenched, and "hard as nails" if it was heated and air cooled. In talking to a large supplier, I was told that this spring platinum would be too hard, but that 95% platinum/ 5% ruthenium should work. The first samples arrived with the temper “as drawn” - they were much too hard to weave - and both wires were nicked and lined. I was less concerned with the surface condition than I was with the hardness of the wires, thinking that if we determined the proper temper, we could get the wires drawn properly. The supplier could not define “as drawn”. He could not tell me how the wires had been made, nor how hard they were. But he was willing to anneal both wires to dead soft. I did weave and shape a clasp with the annealed wires, but the piece was a dull, drab gray. Because of its curls and folds, the Ribbon Clasp can’t be polished with wheels and compounds: I had successfully woven platinum, but I had a product that wouldn’t sell. I could get no response, no answers from the supplier about the cause of the dull finish nor how to prevent or eliminate it.

The following Spring, I asked Jurgen Maerz, Director of Technical Education for the Platinum Guild International, USA, about my search for the proper alloy and the newly identified issue of surface finish. Jurgen told me about new magnetic tumblers with tiny stainless steel needles that could get into the nooks and crannies of my weavings and polish the platinum. He also introduced me to Greg Normandeau at Imperial Smelting and Refining. Greg suggested a number of possibilities: 95% platinum/5% ruthenium for both sizes of wire; 95% platinum/5% ruthenium for the thicker wire and pure platinum for the thinner wire; drawing the wires 1 die hard to improve the surface finish. Greg ran a number of samples from which we learned that even a .002” hard draw produced a wire that was too hard to weave. When we compromised on the surface finish and annealed the wire after the last pass through the draw plate, we were limited by the temperatures attainable on standard equipment and could not sufficiently soften the wires.

Early in 1998, Jurgen introduced me to Jolanda Hoekstra of Engelhard-Clal, who suggested I talk to Dick Lanam, Director, Product Development. At a meeting at the New Jersey plant, I put my gold weavings on the table and told him that I wanted to be able to do the pieces in platinum. After discussing my handweaving process and the results of my search to date, Dick suggested he measure the tensile strength of my 18kt and 22kt gold wires to enable us to select an appropriate platinum alloy. This was the breakthrough I needed! Dick had the patience and the willingness to take the time to teach me his language. He showed me how the scientific analysis of physical properties could be used to guide a decision. I was no longer limited to guesses and trial-and-error! Table 1 presents the measured tensile strengths of my two gold alloys and typical tensile strengths for platinum and a variety of platinum alloys. The selection was now easy: 95% platinum/ 5% ruthenium, at 60,000 PSI was closest to the 70,000+ PSI of my 18kt gold. I chose 95% platinum/5% iridium at 40,000 PSI for the thinner wire because it is a standard jewelry industry alloy. The 97% platinum/3% ruthenium alloy (which at 42,000 PSI nearly matches the measured tensile strength of my 22kt gold alloy) is a special order item. The analysis also shows that pure platinum, at 20,000 PSI, would be wonderful to weave, but not very durable in the long term.

The combination of the platinum/ruthenium warp with a platinum/iridium weft worked very well. I found that platinum Soumak takes longer to weave: it literally takes more time to move the wire weft around the warp. But it's easier to shape than gold; the platinum is more resilient, more forgiving.

The next step, at Jurgen's suggestion, was to send the clasp to Elaine Corwin at Gesswein to determine the tumbling process. Though I had successfully woven and shaped a piece of Soumak, the wire was still a dull, lifeless gray. Elaine put the clasp into a magnetic tumbler with .5mm stainless steel needles for 2 hours, which subtly brightened up the clasp, but also created obvious impingement problems on the larger exposed areas of the warp wires. The dings couldn't simply be polished out. Instead, Elaine switched to .3mm needles at the slowest speed possible for a longer period of time and achieved a much better result. The piece sparkled, and the impingement problem was significantly lessened.

I was so encouraged by my success weaving and finishing the platinum Soumak, that I decided to test the Plain Weave pattern. Based on the tensile strength analysis (remember the Plain Weave uses 18kt gold for both the sheet warp and the wire weft), and my newly gained "finger knowledge", I selected 95% Platinum/5% Ruthenium for both elements. However, unlike the clasp, where I used the same dimensions for the platinum as for the gold, I decided to thin the sheet, so the platinum would be the same weight as the gold. A mathematical calculation suggested I start with .004" thick platinum sheet, which I ordered dead soft. What I received, however, was .0048" thick, almost the same thickness as the gold. I tested it anyway: the thicker platinum sheet was difficult to weave - it wreaked havoc on my fingers, but I was able to complete it and shape it. The next sample was made to my specifications: the .004" sheet was much easier to handle. The thicker sheet, while difficult, produced a brooch that, in fact, is <u>not</u> too heavy to wear. It was a valuable exercise - it defined the upper limit.

Unlike the gold Soumak, which requires no finishing, the gold Plain Weave requires smoothing the edges where the sheet curls around the first and last rows of wire. This smoothing is accomplished with coarse rods, Shofu cones and the occasional use of a burnisher. I expected to have edge work, in fact more edge work, on the platinum brooch. What I did not expect was the roughness of the woven surface itself. It was sharp, almost prickly, where the sheet warp passes over the twisted wire weft underneath. Again, Elaine Corwin had the answer: she put the brooch in a rotary tumbler with steel shot. It came out not only with a smooth surface and edges, but it was brightly polished! It sparkled!

The next step was to find wire suitable for the stickpin. As the attachment mechanism for the brooch, it requires strong, hard wire. For the gold, I use an 18kt pintong, an alloy with a higher copper content that is drawn spring hard. There is no equivalent in platinum, but there are a number of new heat treatable alloys that get hard. Torry Hoover of Hoover and Strong suggested I test the harder of the two alloys developed by Steven Kretchmer: the PLAT/S+™2 works very well for my stickpins.

I knew when I started this journey, that platinum was different from any with which I'd worked. What I discovered along the way is that I could take advantage of that difference to create wonderful jewelry. My journey was possible because many people were very generous with their time and expertise, even when I was not ready to meet their minimum purchase requirements. The one person I must especially acknowledge is Jurgen. He always had an answer for me, always had another suggestion after each brick wall I hit, always had another door to open for me. He has provided me with technical information, with direction, with introductions. I thank Jurgen for his assistance and his enthusiastic encouragement, without which I would not have a platinum product; and for the opportunity to participate in the Women In Platinum symposium.

To those of you who haven't yet taken

the plunge, I encourage you to do so: the metal is different, the product is fabulous and there are many resources to tap for information and assistance.

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Tensile Strengths in the Annealed Condition (PSI)

Measured Tensile Strengths - Round Wire[1]

My 18kt gold .030”	70,000+
My 22kt gold .012”	42,000

Typical Tensil Strengths - Wire or Sheet for a normal range of sizes and purity[2,3]

95% Platinum / 5% Ruthenium	60,000
95% Platinum / 5% Iridium	40,000
95% Platinum / 5% Rhodium	30,000
97% Platinum / 3% Ruthenium	42,000
Platinum	20,000

Sources:

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